# DHRUV KUMAR


CONTACT INFORMATION

4-192 Keller Hall, 200 Union St. SE
Minneapolis, MN
United States - 55414

*Mobile:* (1) 651-955-8923
*E-mail:* dhruv@umn.edu
*URL:* **www.dhruvkumar.me**


RESEARCH INTERESTS

Distributed Systems, Edge Computing, Big Data Analytics, Large Scale Machine Learning.

EDUCATION

**University of Minnesota**, Twin Cities, United States **Sep 2017 - Present**
*PhD in Computer Science*

- CGPA: **4.0 / 4.0**
- 3M Science and Technology Fellowship.
- **Relevant Courses**: Distributed Systems, Machine Learning, Non-Linear Optimization, Dispersed Data Driven Computing, Matrix Theory, Probability and Statistics.

**Birla Institute of Technology and Science** (BITS), Pilani, India **Aug 2010 - May 2014**
*Bachelor of Engineering (Hons.) Computer Science*

- CGPA: **9.92 / 10.0**
- **Rank 1** in Class of 2014 of Computer Science, comprising of 120 students.
- **Rank 3** in Class of 2014 of BITS-Pilani, comprising of 800 students.

RESEARCH EXPERIENCE

**Distributed Computing Systems Group, UMN, Twin Cities** **Jan 2018 - Present**
**Project:** *Geo-distributed Streaming Analytics*
**Mentors:** *Abhishek Chandra, Ramesh Sitaraman*

- Design of algorithms for optimizing Timeliness, Accuracy and Latency in Geo-distributed Streaming analytics.
- Implementation done on top of Apache Flink.

**ADAPT Lab, BITS-Pilani** **Apr 2013 - Oct 2014**
**Project:** *A New Distributed Computing Framework for Data Mining*
**Mentors:** *Navneet Goyal, Poonam Goyal, Sundar Balasubramaniam*

- Designed and implemented data mining algorithms such as OPTICS, SLINK, DBSCAN for shared memory and distributed memory models.
- Used data distribution and task parallelism techniques for exploiting multicore and multinode architectures. Implemented using OpenMP and OpenMPI libraries in C.

PUBLICATIONS

**Dhruv Kumar**, J Li, A Chandra, R Sitaraman. *TTL-based Approach for Data Aggregation in Geo-Distributed Streaming Analytics*, **Poster** at OSDI'18.[Link]

OLD PUBLICATIONS[1]

**Dhruv Kumar**, P Goyal, N Goyal. *An Efficient method for Batch Updates in OPTICS Cluster Ordering*, in IJDATS'18.[Link]

P Goyal, S Kumari, A Sood, **Dhruv Kumar**, Sundar B, and N Goyal. *Exact, Fast and Scalable Parallel DBSCAN for Commodity Platforms*, in ICDCN'17.[Link]

P Goyal, S Kumari, S Sharma, **Dhruv Kumar**, V Kishore, Sundar B, and N Goyal. *A fast, Scalable SLINK Algorithm for Commodity Cluster Computing Exploiting Spatial Locality*, in HPCC'16.[Link]

[1] work done during undergraduate studies

P Goyal, S Kumari, **Dhruv Kumar**, Sundar B, N Goyal, S Islam, and JS Challa. *Parallelizing OPTICS for Commodity Clusters* in ICDCN'15.[Link]

P Goyal, S Kumari, **Dhruv Kumar**, Sundar B, and N Goyal. *Parallelizing OPTICS for multicore systems* in ACM COMPUTE'14.[Link]

## Professional Experience

**Several Startups** **Apr 2016 - Aug 2017**
*Technology and Strategy*

- Designed and implemented the entire back-end for three startups from scratch.
- The entire back-end functionality was exposed using RESTful APIs implemented using Django web framework and hosted using Amazon web services.
- Gained valuable experience in building scalable and secure back-ends for web and mobile applications.

**Goldman Sachs, Bengaluru, India** **Nov 2014 - Apr 2016**
*Software Developer, Investment Management Division*

- Improved the efficiency of risk-management system by suggesting improvements to the SQL queries going to Sybase IQ database.
- Assisted in migrating from Sybase IQ database to MemSQL database for faster access.
- Wrote APIs for accessing MemSQL database.
- Implemented a H2-database based server for allowing real-time updates to the tables residing in the servers.
- Learnt about the real life use-cases of databases.

**CSIR-CEERI, Pilani, India** **May 2012 - July 2012**
*Machine Learning Intern*

- Studied, compared and implemented various unsupervised machine learning algorithms.
- Learnt about the use of these algorithms in real world applications

## Selected Academic Projects

**Distributed System for Federated Multi-Task Learning** **Oct 2018 - Dec 2018**

- Designed and implemented a real distributed architecture for applications which require iterative and collaborative processing in edge environments, taking Federated Multi-Task Learning as an application.
- Used Sockets and Message Queues for client-server communication.
- Introduced the concept of trusted device groups.
- Introduced resource management components for compute, battery and task migration.

**Peer-to-Peer File System** [Code] **April 2018**

- Implemented a *serverless* file system based on the classic xFS paper in which peer nodes can share their files directly with other peers.
- Supported multi-threading, load balancing and fault tolerance.

**Bulletin Board Consistency** [Code] **March 2018**

- Implemented a simple Bulletin Board system (like Moodle Forum) in which clients can post, reply, and read articles stored in the Bulletin Board.
- Supported multi-threading, various types of consistencies and replication.

**PubSub System** [Code] **February 2018**

- Implemented a simple publish-subscribe system (PubSub) using UDP and RPC protocols.
- Compared its design and performance with Google Cloud PubSub system.

**Win-Loss Prediction for Chess using Machine Learning** **Nov 2017 - Dec 2017**

- Training data comprised of endgames with 6 or lesser number of pieces remaining. For such endgames, Nalimov Tablebases have win-loss score for every possible configuration.
- Trained a variety of models including logistic regression, Neural Networks.
- Achieved an accuracy of 85% on the validation dataset.

**Complier Construction for a "Toy" Language** **Jan 2013 - Apr 2013**

- Designed lexical, syntax, semantic, code generation phases of compiler in C.
- Efficient use of Hash Tables for constructing symbol tables.

## Technical Skills

- **Programming:** C, Java, Python, OpenMPI, OpenMP, MySQL, Verilog, Matlab
- **Mobile and Web Technologies:** HTML, CSS, JavaScript, AngularJS, Django, Android
- **Cloud platforms:** Amazon web services

## Honors and Awards

- Student Grant for OSDI'18.
- Awarded a four-year 3M Science and Technology Fellowship for pursuing PhD at the University of Minnesota, Twin Cities. [**Aug, 2017 - May 2021**]
- Awarded merit scholarship of total worth Rs 4,75,000 for being in top 10 students among 800 students of BITS, Pilani by the institute. [**Aug, 2010 - May 2014**]
- Awarded research incentive fellowship of Rs 25,000 in recognition of the contribution in the undergraduate thesis project. [**May 2014**]